DOCUMENT RESUME

ED 038 326 SE 008 406

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TITLE	The Function of Verbal Rewards in the Science Classroom.
INSTITUTION	Columbia Univ., New York, N.Y. Teachers College.
PUB DATE	Mar 70
NOTE	19p.; Paper presented at Annual Meeting of the National Science Teachers Association (Cincinnati, Ohio, March 12-16, 1970)
EDRS PRICE	EDRS Price MF-$0.25 HC-$1.05
DESCRIPTORS	*Elementary School Science, *Interaction Process Analysis, *Learning, *Motivation, Reinforcement, *Rewards, Science Course Improvement Project, Secondary School Science, Verbal Stimuli
IDENTIFIERS	Science Curriculum Improvement Project

ABSTRACT

Contained is a review of the research done on the use of verbal rewards in the classroom. Some verbal rewards are tasks rewards, other rewards are more personal; and still other verbal rewards are impersonal. Verbal rewards, therefore, have both intellectual and emotional implications. Research literature indicates that "verbal reward" constitutes a significant portion of what the teacher does in the classroom. Relative to the teaching of science, researchers have found that teachers in primary grade classrooms follow typical patterns of reward giving while using the new science programs. They strive to function as sources of information and incentive despite the nature of the curriculum. Teachers give the same ratio of positive evaluations (rewards) to negative evaluations: four positive evaluations for every negative evaluation to students who are correct and to students who are incorrect. In a study undertaken by the author it was found that SCIS experienced students worked more slowly under reward than under the no reward condition while non-SCIS experience students worked more quickly under reward. (BR)

ED038326

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THE FUNCTION OF VERBAL REWARDS IN THE SCIENCE CLASSROOM

by

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Prepared for presentation at the
Annual Meeting of the
National Science Teachers Association
March 15, 1970

SE 008 406

A great many educational researchers have discovered the classroom! They have descended upon the classroom with audio recorders, video recorders and notebooks. They have accumulated mountains of data. They have analyzed the classroom scene in terms of scores of category systems. It is painfully clear that the process of teaching is as complex as its corollary, the process of learning! One way to attack this complex situation in order to find out how it works is to pick out a single variable and put it under the microscope. Let's pull out a variable which intuitively seems important. Let's look at the Teachers system of verbal reward.

What are verbal rewards? When a teacher uses such phrases as: "That's right", "Very good", "You are doing very well", "Excellent", "You really know how to do that", he or she is using what I call, "Verbal rewards". Such statements are referred to in the psychological literature as "social reinforcers", "verbal reinforcers", "praise", or "positive feedback".

Before we begin to see what research has to say on the subject, there are several interesting distinctions that we can make about verbal rewards. Some verbal rewards are task rewards. These refer to a job well done, for instance: "Good job", "That is fine". Other phrases are more personal. They direct praise at the child, rather than to the task: "You did very well", "You are smart". Other rewards are rather impersonal, and seem somewhat neutral from an affective viewpoint. These might be called feedback responses: "Correct", "Right", "OK".

Why use verbal rewards? Verbal rewards have both intellectual and emotional implications. They carry information concerning the correctness or acceptability of a response or activity and they imply approval with all its emotional overtones for both the giver and the receiver of the approval. It is obvious right away that the various kinds of verbal rewards: feedback, task and personal, may each have different informational and affective loadings. When we consider the cultural backgrounds and past educational experiences of individual teachers and children, the picture, especially from an emotional point of view, can become very complex. In the most simple terms, teachers can use rewards for informational and motivational purposes, and the degree to which each goal is served by verbal rewards can be highly variable.

Do teachers really use verbal rewards in the classroom? The evidence supplied by transcripts of classroom discourse on all grade levels gives a strong "Yes" to this question.

In general. The originators of various category systems for the analysis of classroom behavior include "verbal reward" in one or more of their categories. The Flanders[1] system had a category called "praise" which includes verbal reward behavior of the teacher. Studies by Flanders and Amidon have found that this category accounts for one to two per cent of teacher-talk. Lohman,[2] using a similar system, found that it amounted to from 1.14 per cent to 3.74 per cent of teacher-talk; Hough[3] from 2.79 per cent to 3.62 per cent; Hughes[4] used a category called "positive affectivity" which accounted for from 10 to 20 per cent of teacher moves. This is a broad category

which includes more than teachers' responses to pupil behavior; the "response" category in this study encompassed three to ten per cent of teacher moves.

The work of Zahorik. In his study on the nature and value of teacher verbal feedback, Zahorik[5] used 25 categories into which he assigned the verbal remarks of teachers which reflect on the adequacy or correctness of pupil statements. The subjects of this study were eight third-grade and seven sixth-grade teachers and their classes of pupils. The lessons were current event discussions. The analysis of the tapes and transcripts shows that "simple praise-confirmation" constituted 28.63 per cent of the verbal feedback instances, or 619 times out of a total of 2,162. This type of response is the most frequently-used mode of the teachers in the lessons Zahorik analyzed.

The work of Bellack. Bellack refers to reacting moves of teachers which relate to preceding moves of students. A sub-category of reacting moves is "rating reactions," one of which is positive (distinctly affirmative rating, e.g., "yes, right, correct, exactly, precisely"). Reactions account for 39.2 per cent of all teacher moves (44.7 per cent of lines spoken by the teacher). The authors state:

> Rating reactions account for the largest percentage of teacher reactions: 46.2 per cent of all reacting moves by the teacher are in this category. This clearly reflects one of the teacher's major functions in the classroom, which is to rate statements made by students.[6]

They go on to state that reactions which are basically positive account for 80 per cent of the teachers' rating reactions, with one-third of these in the distinctly affirmative category.

In summary, this literature indicates that "verbal reward" constitutes a significant portion of what the teacher does in the classroom.

Since psychologists have been deeply cnncerned with reinforcement in connection with almost all theories of learning, their research is a logical place to start if we are to understand the function of verbal rewards in the classroom. An examination of this research would be a gigantic task were it not for the fact that most of it is directly concerned with animals, infants, or retardates. We will limit ourselves to research using rewards with young children.

Motor task research. About one-third of the research on social reinforcement makes use of a task called the "marble-in-the-hole game." The task requires children to drop marbles through small holes into bins. Achievement is usually measured in terms of the total number of marbles dropped through the holes or number of responses per minute compared to the number per minute during a base-line period. Persistence times are also a dependent variable in some of these studies. In other motor task studies, the force exerted or the rate of pulling levers or of turning dials is measured.[7] When two-choice probability games are used (20 per cent of the studies reviewed), the number of correct guesses is the dependent variable. Many of these reward studies show that there are mediating variables which modify the subject's reaction to reward. Stevenson and Allen[8] and Hill[9] found an interaction between sex of experimenter and sex of subject. This is a factor which is important for the application of results to the classroom situation. Gewirtz and Baer,[10] Hill and Stevenson,[11] Dowart,[12] and Berkowitz and Zigler[13] all found that subjects who, before beginning the experimental task, were isolated for about ten minutes, had faster motor performance under the reward condition than subjects who were in a social situation before the experiment. Similar experiments were carried out by Lewis and

Richman,[14] McCoy and Ziegler,[15] and Berkowitz, Butterfield, and Zigler,[16] which found that social contact with the experimenter prior to the experiment had an effect upon the response to reward. These effects emphasize for us the complexity of the situation encountered in the classroom. They suggest that boys and girls may react differently to the verbal rewards delivered by male or female geachers and that the past experiences of the students may most powerfully modify their reaction to reward.

Walters and Ray[17] and Hill[18] found that anxiety of the subjects was an important variable. Highly anxious subjects showed greater response to the reward condition. Epstein[19] showed a similar effect due to the subject's need for approval. A study by Harootunian and Koon[20] showed that highly anxious teachers use different verbal reward patterns than low anxiety teachers. Therefore, personality of both teacher and pupil is a factor to be considered in the verbal reward situation.

Social Class of the subjects is a variable which was considered in studies by Douvan,[21] Zigler and Kanzer,[22] Rosenhan,[23] Zigler and Williams,[24] and Terell, Dunkint, and Wiesley.[25] These studies indicate that personal rewards are more effective with lower-class children and task rewards with middle-class children. Although these results have not been replicated by Lighthall and Cernius[26] and other investigators, nevertheless social class presents itself as another variable in this complex picture.

The tremendous effort expended in the study of verbal reward using motor task situations serves to make us aware of the complexity of the variable, but the application of these results to the classroom is open to two very serious challenges. The first was voiced by Parton and Ross[27] in their review of this literature where they raised serious

questions about the use of rate as a measure of response. The second objection is less technical but more important to those working in educational areas where pupils must seek answers to problems from objective experience. Lighthall and Cernius state:

> The literature on social reinforcement, reviewed by Stevenson (1967) and Parton and Ross (1963), is based on an amazingly narrow sample of tasks, virtually all of them of the motor-performance variety. The almost universally adopted task is the "marble in the hole" task used by Ziegler (etc).... There is no objective information in the manipulanda of the social reinforcement studies that can be scrutinized by S as a basis for correctness of the response. The basis of correctness resides in the recesses of the experimenter's mind. The manipulanda...have no stimulus characteristics relevant to success or failure in response.... The child's task is to find out what the experimenter has in his mind. There is no other task.[26]

Concept formation studies. A number of the studies examined (20 per cent) which made use of verbal reward used a "concept formation" task similar to those used by Bruner in his work. In this type of task, "reward" indicates a positive instance; in other words, a statement such as "That is correct" supplies information to the subject that an object or figure possesses some critical property. The subject must abstract the critical property by determining what all "rewarded" or "reinforced" instances have in common. Dependent variables in this research are: number of trials needed to reach a criterion performance, or, time needed to reach criterion performance. Even though some researchers in this area, such as Carpenter,[28] refer to the verbal responses to subject activity as "reward," this type of response does not conform to the definition of reward as used here. In research carried out in the concept formation vein, such as that of Buchwald,[29] Buss and Buss,[30] Mayer and Seidman,[31] the reward or reinforcement functions as a guide to concept formation (a feedback function) rather than as a motivational

determinant. Each "That is correct" or "That is wrong," although it may be an implicit reward or punishment, primarily transmits a certain amount of information toward the formation of a generalization. "The manipulanda have no stimulus characteristics relevant to success or failure." The child's task is still to find what concept the experimenter has in his mind. Without the feedback of the experimenter there would be no success.

Another difficulty we face when we attempt to apply these results to the classroom is that the work in this area does not make explicit reference to motivational variables. Since motivational elements are pertinent to such research, it is surprising that such considerations have not been given more attention. A study by Hoffman, Burke, and Maier[32] made an effort in this direction. Using positive and negative verbal reinforcement with college age subjects working on a simple hat-rack problem, they found that this treatment had no effect on performance on a new but similar hat-rack problem. They concluded that reinforcement is · levant for problemsolving at this age level. In other words, for adult subjects the motivational function of reinforcement is not important in a problem-solving situation. Marsdad,[33] in a blindfolded, dart-throwing game, tried to isolate the information function of feedback from the reinforcement or incentive function. He concluded: "The addition of what would operationally be described as incentive to information alone debilitates rather than enhances performance." It is interesting that the task used in this experiment required information from the experimenter for improving performance. We are led to speculate on what would happen to performance where the task supplied both information and incentive. In this case would both information and reinforcement debilitate performance? Perhaps we approach this condition in connection with feedback in programmed instruction.

Programmed Instruction. B. F. Skinner, whose work has been very influential in the field of programmed instruction, in a recent book on this subject quotes with approval the French philosopher Rousseau: "Away with man made rewards!"[34] He recommends the use of "natural rewards" which he illustrates in this manner: "We are reinforced when a piece of string becomes untangled, when a strange object is identified, when a sentence we are reading makes sense."

Skinner stated in an interview in 1956 that he felt the use of the teaching machine was itself so enjoyable "that no further reinforcement is needed."[35] However, elsewhere Skinner states that the machine "like the private tutor reinforces the student for every correct responce, using the immediate feedback not only to shape his behavior most efficiently but also to maintain it in strength in a manner that the layman would describe as holding the student's interest.[36] In describing reinforcers in this context, Skinner sees the display of the correct response as a reinforcer and also mentions as reinforcing "simply moving forward after completing one state of activity." In short, a basic postulate of the Skinnerian view is that "the sheer manipulating and control of nature is itself reinforcing." As a consequence of this approach, one does not find "verbal reward" as such used in the programmed instruction research which is based upon the work of B. F. Skinner.

In the usual programmed instruction material, immediate feedback, in the form of the correct responses, is assumed to have the connotation of the statement, "you are correct," or "you are wrong." Some of the computer programs, however, make such statements explicitly. In the first case, one might see the "reward" as implicit and in the latter case, as an explicit "reward." In both cases there are positive and negative effects postulated. On the positive side, such "rewards" are

seen as important for maintaining an optimum level of device operation and for increasing the level of persistence of shaped behavior. On the negative side, the "reward" acts to correct wrong responses which might inhibit the learning of new material. From one point of view these effects are ascribed to a process of strengthening of habits. Another point of view would see the reinforcer as providing motivation for the use of certain responses on future occasions.[38]

Some attention is paid in the literature to the relative merits of feedback which is contingent upon the response of the learner, as is possible in computer-assisted programs, versus feedback which merely provides a statement of the correct responses. Gilman, working with 66 ninth- and tenth-graders and a Fortran learning program, found no difference in retention between these two kinds of feedback.[39] Some of the research in this area contrasts the effects of giving feedback after the response of the student with giving similar information as a "prompt" before the student response. This research is inconclusive, a fact which may bring into question the idea that feedback following a response serves anything more than an informational function. If such is the case, in programmed instruction research we may be dealing with variables which are not closely analogous to those encountered in "person to person" verbal reward research.

At the very least, programmed instruction research indicates that "person to person" interaction is not necessary in the learning situation. The research also indicates that the manipulation of the equipment is rewarding in that it stimulates interest and provides motivation. There does not seem to have been an attempt in this research to examine separately the informational and the motivational aspects of feedback.

The Modern Science Classroom

A great deal of effort in science education during the past decade has been put into the development of curricula which have as an implicit and basic assumption the idea that the manipulation of objects and systems is both intrinsically motivating and has informational value. Perhaps this idea did not begin with the PSSC curriculum and its descendants, but it certainly has been basic to the "new science" movement. In science education, we are committed to the idea that students should obtain tentative answers by working with the real world rather than gathering fixed sets of conclusions from some authority. In pursuit of this goal various science curricula have been developed which supply the student with an assortment of materials with which he encounters various phenomena. Some of these programs, such as: Science A Process Approach[40], The Elementary Science Study[41], and the Science Curriculum Improvement Study[42], involve children in this experimental approach from kindergarten through the sixth grade. Essential to all of these programs is the childs encounter with problems which can be solved by the systematic observation of the properties of objects in systems. The child is led to experience the regularities of nature and to investigate the apparent anomalies. The cognitive conflict produced by the clash between the expected and the experienced, between the data produced by one child and that of another child, or by the questions posed by the teacher, is intended to produce further

manipulation of the world where tentative answers can be found. The teacher in this scheme is not intended to be the source of information, information is inherent in the system. Nor is the teacher the source of motivation, motivation is to flow from the manipulation of the system. We must therefore reappraise the role of the teacher as the reward giver: the source of information and the source of motivation.

What teachers do. The work of Rowe[43] and of Sikoura[44] indicates that teachers in primary grade classrooms follow typical patterns of reward giving while using the new science programs. They strive to function as sources of information and incentive despite the nature of the curriculum. These studies indicate that the findings of Bellack and of the others mentioned earlier are replicated with teachers working with much younger children in a different subject matter context. Perhaps the most surprising aspect of this rewarding behavior is that it is not correlated with achievement. Teachers consistently gave the same ratio of positive evaluations (rewards) to negative evaluations: four positive evaluations for every negative evaluation, to students who are correct and to students who are incorrect. In other words, rewards are randomly distributed with respect to achievement.

Theoretical Considerations. Research by Atkinson and others[45] indicates that problem-solving activity has a certain intrinsic m motivating aspect if the subject foresees that performance is instrumental to producing a feeling of pride in accomplishment.

This is achievement motivation. If, on the other hand, rewards are delivered to the problem-solver from a human source, these may function as affiliation cues which may then become more prominent in the problem-solving situation than achievement motivation. When this happens, the subject may begin attending to cues which are extrinsic to the problem and his cognitive problem-solving activity will be less effective. These considerations suggest a basis for the prediction of possible outcomes in a reward situation where the task involves manipulative problem solving activity. In such a task situation, verbal rewards given to the pupil by the teacher will result in lower achievement than an attitude of quiet attention on the part of the teacher.

Experimental Verification. Previous research on verbal reward offers little evidence for the prediction of the effects of verbal reward in a task situation typical of the new elementary school science curricula. For this reason an experiment was carried out by the author[46] which was intended as a first step in the investigation of the function of verbal reward in modern elementary school science classrooms. An abstract of this research is attached as an appendix to this paper. Essentially, the results indicate that under a reward condition analagous to that found in the classroom children's problem solving behavior is less efficient than under a no reward condition or under a condition of rewards delivered only for acceptable achievement. Much remains to be done in this area. We must certainly find out the effects of verbal reward on manipulative problem solving in the group situation and with individuals of low socio-economic status.

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RESEARCH ABSTRACT

THE EFFECTS OF VERBAL REWARD ON THE BEHAVIOR OF CHILDREN IN THE PRIMARY GRADES AT A COGNITIVE TASK TYPICAL OF THE NEW ELEMENTARY SCIENCE CURRICULA

FRANCIS X. LAWLOR

Research shows that teachers exhibit relatively fixed verbal reward patterns and that this rewarding is not highly congruent with the cognitive behavior of the pupil. There has been very little research which deals with the problem of the present study, namely, to determine the effects of verbal reward upon the problem solving behavior of children working at cognitive tasks.

Three treatments were used which modeled the reward conditions which seem to occur in the classroom: 1) a neutral, no overt reward condition; 2) rewards delivered only for acceptable solutions to the task problem (Pertinent Reward); 3) a condition in which reward is not congruent with task achievement, in which rewards are delivered on a fixed time schedule (Non-pertinent Reward). This last condition is most analogous to classroom practice.

The two tasks employed required students to categorize objects on the basis of properties. These tasks are typical of first grade tasks in the new science curricula developed with NSF funding (e.g. SCIS, AAAS, ESS). One of the objectives in these programs is to produce settings in which the child uses cues which come exclusively from the system rather than from some extrinsic source. Results of the present study suggest a modification of present teaching strategies which make them more appropriate for these curricula.

The subjects of this study were 202 second graders from a middle class suburban school district. Each subject was tested individually by one of eight trained testers. The dependent variables were: 1. Total number of solutions; 2. number of acceptable solutions; 3. the ratio of acceptable solutions to total solutions (the E Ratio); 4. perseverence time; 5. number of seconds per solution; 6. sequence of solutions The subjects were boys and girls; one half of the subjects had had the SCIS program in first grade. The testers were male and female graduate students Analyses of variance and covariance were used to evaluate the data.

Eleven subjects who were unable to sort objects dichotomously on the basis of properties were eliminated by a preliminary screening task. The reward conditions had a significant effect upon the E Ratio Subjects in the Non-pertinent Reward condition had a relatively low E Ratio in comparison with the subjects in the No Reward and in the Pertinent Reward conditions. Female subjects in the Pertinent Reward condition had very high E Ratios, a fact which may be due to an effective use of the informational aspects of this type of reward. No significant differences were observed between mean scores of subjects in the three reward conditions in relation to the other dependent variables.

The two tasks, Wood Blocks and People Blocks, showed differences in stimulus complexity. The People Block task was generally more sensitive to the experimental conditions. The only differences detected between SCIS and non-SCIS experienced subjects was that the SCIS subjects worked more slowly under reward than under the No Reward condition while the non-SCIS subjects worked more quickly under reward. The mean E Ratios of subjects tested by males were higher than those of subjects tested by females

When middle class children are treated on an individual basis, the use of indiscriminate verbal reward procedures produces less effective problem solving behavior than either a neutral condition or the delivery of rewards which are congruent with acceptable problem solving. By manipulating task complexity it should now be possible to test for these effects with children of other socio-economic backgrounds. Following this step the next important phase of this research will be the study of the effects of verbal reward on the problem solving behavior of children in small groups. The effect of reward (Pertinent and Non-pertinent) must be determined both for the recipient and for the non-recipients in a situation which has more potential for competitive motivation.